LITERATURE

Comments on Recent Literature

Development of Plumage Color Patterns. For the experimental biologist investigating the factors that control the processes of development, a major problem has been the selection of well defined criteria of embryonic differentiation, which, in response to experimental treatment, undergo definite, unequivocal changes. The striking and intricate plumage color patterns of birds, long recognized as important tools by students of speciation and evolution, afford an unexcelled system for the experimental analysis of problems in embryonic differentiation. Willier (1942, 1948) has emphasized the advantages of the feather papilla in this respect: (1) it appears regularly after plucking the feather and is thus readily accessible for experimental study, and (2) it has many characteristics of a developing embryonic organ, for example, axial organization, inductor action, and physiological gradients in response to various stimuli. Willier also has reviewed the recent advances in our knowledge of the genetic and environmental (particularly hormonal) control of development contributed by studies on the differentiation of plumage pigment patterns in the fowl. Most widely studied have been a group of pigments, called melanins, that are probably derivatives of the amino acid, tyrosine, and that range from yellowish brown to black, and that are deposited in the feather in the form of granules by branched pigment cells, the melanophores. These highly specialized cells have their origin in the embryonic neural crest and migrate while in an immature, unpigmented form (melanoblasts) to the feather papillae of the skin. (For extensive review of this phase of the problem, see Rawles, 1948.)

Of the components essential to melanin pigmentation of the feather, only the melanophores have an extrinsic origin. This condition makes it possible to produce feathers which are characteristic, in every respect, of the pigmented breed from which they were derived, except for a complete absence of color. This production is accomplished by transplanting the embryonic limb bud of a pigmented breed, prior to the entrance of the melanoblasts, to the coelom of a White Leghorn embryo, an environment essentially free of pigment cells, where normally shaped, but unpigmented, feathers are formed.

The melanoblasts, under certain physiological conditions as yet poorly understood, invade the feather papille, and are there subject to the action of environmental factors imposed by the growing papillae. The specific response of the pigment cells is, however, governed primarily by their genetic makeup. For example when neural crest cells of one breed are grafted into an embryo of another breed, the resultant color pattern in the host feather invariably resembles that of the donor breed. The analysis of Willier and Rawles (1944) who tested the response of melanophores derived from embryos that have

sex-linked differences in plumage coloration showed that in every instance the kind of response corresponded precisely with the genetic constitution. The response may be uniform in all parts of the body, as in the Black Minorca, or may vary from tract to tract, or even from feather to feather within a tract, depending on the locus of the feather papilla in which the pigment cells occur. However, there is no correlation between the origin of melanoblasts and their differential tract responses. Young pigment cells at all axial levels are identical, as can be seen when they are studied after transfer to ectopic positions. In such experiments the feather color pattern is invariably that of the new position, never of the site of origin. Thus, if melanoblasts of the saddle region are transferred to the wing, the pattern produced is a typical wing pattern. The melanoblast itself, therefore, is not "tract-specific", but is only capable of responding to specific influences of the other components of the feather papilla, and tract differentials must be attributed to regional differences in the physiological characteristics of the papillae. That such differences exist has been shown by injections of female sex hormones into Brown Leghorn capons. In this "estrogen-sensitive" breed, injection of estrogen into the male or capon produces a characteristic abrupt change in pigmentation pattern in the saddle, neck-hackle, and breast regions. The feathers in each region, however, have a distinct threshold of reaction, in that concentrations affecting those in one region may have no influence on those in another. Furthermore, feather papillae within a tract may exhibit an orderly spatial arrangement of response to sex hormones, and in general, the response of the melanoblasts to estrogen is a function of the position of the feather papilla within the tract.

In addition to the melanoblasts, the feather papilla contains 2 components essential to normal differentiation: (1) the dermal papilla is the permanent body of the follicle, without which regeneration is impossible; (2) the epidermal component that, as a result of "induction" by the dermal papilla, produces a new feather. The epidermal component forms anew with each regeneration. In a series of well controlled experiments, Lillie and Wang (1944) and Wang (1943) have demonstrated that the dermal papillae are not tract specific in their organizing action, but that the specificity of response in feather regeneration is due to the specificity of the epidermal component. A dermal papilla of the breast placed in a saddle follicle leads to the formation of a saddle feather, and conversely a dermal papilla of the saddle region placed in a breast follicle induces a breast feather. It would appear, therefore, that the response of melanoblasts to estrogen is conditioned by the properties of the epidermal component of the feather germ. This conclusion has been confirmed by Trinkaus (1948) who further demonstrated that the inability of melanoblasts in young chicks to respond to estrogen is due to an "immaturity" of the epidermis. To show this, it was necessary to combine melanoblasts from an adult (in which they normally respond to estrogen) with epidermis of an immature papilla,

and following their establishment, to test the effects of estrogen. The results are summarized as follows: (1) when melanoblasts of regenerating breast feathers of an adult Brown Leghorn capon are transplanted to the wing bud of a 72-hour White Leghorn embryo, the coloration of the down and pigmentation pattern of the juvenile feathers of the host are typically like those of the donor chicks. (2) Upon administration of estrogen, these melanoblasts show no response, which is in contrast to the marked response of similar melanoblasts to estrogen when in the epidermis of breast feather germs of the adult.

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James D. Ebert

Book Reviews

Know Your Ducks and Geese. A. H. Shortt and B. W. Cartwright. Sports Afield Publishing Co., Minneapolis, Minn. 1948. $5.00.

This book, a superb example of a combination of art and science, presents excellent portraits of 36 ducks and geese with concise, modern descriptions. For each species there is a 10 x 12 inch colored plate of 1 or more individuals in flight and, printed on glassine paper, there is a small black and white sketch of male and female on the water, a map of the wintering and breeding distribution and a discussion of distribution, migration, food, weights, courtship, and nesting as well as references and a description of various plumages. The book measures 12 x 14 inches and is bound in padded leatherette. The low price is truely amazing in these days. The plates, made from oils or water-colors by A. H. Shortt, are lively, colorful, have splendid backgrounds, and are true to life. The picture of a pair of Cinnamon Teal exploding from the water, and that of the Baldpates settling quietly into the marsh are especially satisfying. The text, written by B. W. Cartwright, is a model of brevity and clarity. The emphasis on courtship and nesting data exemplifies modern studies of ducks. The Wilson Ornithological Club can indeed be proud that two of its members have produced this outstanding contribution.

David E. Davis

The American Wild Turkey. Henry E. Davis. Small-Arms Technical Publishing Co., Georgetown, South Carolina. 1949. 319 pages, illus. $5.00.

For hunters of our finest game bird, this book provides an interesting merger of personal adventures and opinions with the scientific data culled from the excellent research of Mosby and Handley. Much of the book deals with methods of hunting. Concerning conservation of